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Airway smooth muscle in health and disease; methods of measurement and relation to function.

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Smooth muscle is present and probably functional in the airways in utero and increases in absolute area during growth with little further change during adulthood. It encircles the entire airway below the level of the main bronchus, in a roughly circular orientation, except at high lung volumes. It occupies relatively more of the airway wall in the peripheral airways, reaching a maximum in the membranous bronchioles. Measurement of smooth muscle area in the airway wall is confounded by clinical classification of cases, methods of tissue retrieval and preparation, staining and orientation of sections, magnification, image analysis and statistical methods of comparison between groups. Airway smooth muscle area is pathologically increased in inflammatory conditions of the airways such as chronic obstructive pulmonary disease, in relation to airways obstruction, and asthma, in relation to severity and airway size (between 25 and 250% compared with control cases). It is increased in sudden infant death syndrome, but there are few studies in other conditions such as bronchiectasis. In asthma, smooth muscle must shorten (not necessarily to an abnormal degree) for the structural abnormalities of the airway to manifest as excessive airway narrowing. Not surprisingly there is renewed interest in the relationships between the mechanical and contractile properties of smooth muscle, parenchymal properties and lung volume and how these interact to determine smooth muscle length. The relative importance of smooth muscle area and mechanical properties, altered airway structure and airway inflammation in disease are yet to be determined.

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